

**REMARKS**

The application has been amended so as to place it in condition for allowance at the time of the next Official Action.

The Official Action objects to claim 9 based on an identified informality. Applicant has amended this claim to eliminate the basis for this objection, the reconsideration and withdrawal of which are therefore respectfully requested.

The Official Action objects to the drawings under 37 CFR §1.83(a) for failing to show every feature of the invention specified in the claims. Specifically, the transmission x-ray source of claim 5 is identified as failing to be illustrated by the drawings. Applicant notes that element 2, illustrated at least in Figures 4-6, is an x-ray source such as that referred to throughout the claims, including claim 5. Additionally, applicant has amended claim 5 to recite an x-ray source that produces parametric X-radiation. Reconsideration and withdrawal of this objection are therefore respectfully requested.

The Official Action rejects claims 1-20 under 35 USC §112, second paragraph, as being indefinite. The

Official Action identifies specific terms that underlie this rejection.

The first term identified in the present rejection is "specific spatial coherence", and more specifically the word "specific" therein. Applicant notes that that term was used in the claims as originally filed to refer to a specified or known spatial coherence. The present invention includes as a characteristic thereof the requirement that the phase contrast x-ray device include at least one x-ray source that produces X radiation at a known spatial coherence within a predetermined distance from the emitting x-ray source. Applicant has amended the present claims to replace the word "specific" with "known".

The term "optical distance" is used throughout the present specification in connection with dimension 6, as illustrated in Figures 1, 2, and 4. As is clear from these illustrations and as the term is used throughout the specification, this term refers to a distance from the x-ray source. Accordingly, the present claims are now amended to recite a predetermined distance from the x-ray source.

Applicant has replaced "shows an output ranging" with "has an output ranging", merely to improve the clarity of this recitation.

The term "spatial coherence length" is a term well known in optics that is derived from the coherence condition: " $d\lambda = \lambda / \sigma$ ".

This formula states that the spatial coherence length is equal to resolved structure in the object  $\ll$  source-object distance \* wavelength/source emission. The applied Wilkins et al. reference makes clear that the terms "spatial coherence" and "lateral coherence" mean the same thing, as is evident from the specific use of the term "high spatial coherence or lateral coherence" on page 336, column 1, line 2 of such reference. Additionally, the Wilkins et al. reference specifically identifies "lateral coherence length" in connection with the above-identified formula.

For these reasons, applicant suggests that this term is well known to those of skill in the art.

As to the parametric x-ray source of claim 5, please note that applicant has amended claim 5 to recite that the x-ray source 2 is of a type that produces parametric X-radiation. Parametric X-radiation is a term that is believed to be well known in the art.

The Official Action identifies other bases for rejection, each of which is addressed by an amendment to the appropriate claim.

The Official Action rejects claims 1-20 under 35 USC §112, first paragraph, as failing to meet the enablement requirement thereof. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The first basis for this rejection is the recitation of an x-ray source whose power output may be varied from 50 W to 10 kW while emitting x-rays that are coherent. Please note that the wattage range is not a statement of adjustability of the invention, but rather a range within which the x-ray source lies as part of the present invention.

As to the statement of coherence, applicant notes that x-ray sources such as x-ray tubes are *per se* not coherent sources. In this way, x-ray sources, like conventional light bulbs, do not emit coherent light, in contrast to lasers which, by definition, emit coherent radiation. However, even non-coherent sources can be used to study the effects of coherence if the condition of coherence is fulfilled. This refers to the spatial or lateral coherence described above. This applies to x-ray sources, and is the characteristic that underlies the phase contrast device of the present invention. The coherence condition is such that for sources that are incoherent *per se*, the ratio

of this source size and the source-object distance must be considered in a phase-contrast x-ray device.

As to the subject of processing several phase contrast images to form an overall phase contrast image, in processing several phase contrast images to form a phase contrast computer tomogram, applicant suggests that these steps are well known to those of skill in the art. As is noted in the present specification describing the prior art, phase contrast image formation is not, in and of itself, a new science. The present invention is novel and non-obvious at least to the extent that it provides for new structure and method to produce a phase contrast image. The subsequent steps of processing a plurality of such images to form an overall phase image or a phase contrast computer tomogram is not the invention of the present application.

The Official Action rejects claims 1-20 under 35 USC §103(a) as being unpatentable over the S.W. Wilkins et al. "Phase-Contrast Imaging Using Polychromatic Hard X-Rays", Nature, V.384, 1996, pp. 335-338. Reconsideration and withdrawal of this rejection are respectfully requested for the following reasons:

The Wilkins et al. device includes a number of limitations that are in specific contrast to the present invention. At the very least, the Wilkins et al. device

fails to meet the power range requirements of claims 1 and 12. As noted on page 2 of the present application as originally filed, in light of the smaller diameter of the point-shaped x-ray source of devices such as that of Wilkins et al., the output of the x-ray source is restricted to a range below 50 W. As a direct result of this limitation, the phase contrast x-ray device of Wilkins et al. is only suitable for creating a phase contrast image of a very thin, small object, such as an insect. It is completely unusable for objects on the scale of the body of a human being.

More generally, the Wilkins et al. reference provides no significant disclosure whatsoever as to the output of the x-ray source. The reference merely mentions that the source leads to x-rays with an energy of 20 keV and 40 keV, respectively. In addition, Wilkins et al. teach that it is necessary to have a small source size of the x-rays for the purpose of achieving appropriate lateral coherence. This teaching would lead one of skill in the art to reduce the size of the source of x-rays with the effect that the output of the x-ray tube is very small.

In light of the amendments provided above and the arguments offered in support thereof, applicant believes that the present application is in condition for allowance


and an early indication of the same is respectfully requested.

If the Examiner has any questions or requires further clarification of any of the above points, the Examiner may contact the undersigned attorney so that this application may continue to be expeditiously advanced.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17.

Respectfully submitted,

YOUNG & THOMPSON

  
Eric Jensen, Reg. No. 37,855  
745 South 23<sup>rd</sup> Street  
Arlington, VA 22202  
Telephone (703) 521-2297  
Telefax (703) 685-0573  
(703) 979-4709

EJ/mjr